PIPELINE MAPPING SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

This invention relates to mapping position, structure and condition of main and branch-off lateral sewage and other liquid-conveyance pipelines for maintenance and repair.

Pipeline inspection devices are well-known. Most have TV cameras for remote observance and are propelled through the pipelines with various mechanical linkage, crawler mechanisms or water-nozzle reaction thrusters. However, there are no known pipeline mapping systems and methods as taught by this invention.

Examples of known pipeline inspection devices that are most-closely related but yet different are described in the following patent documents. U.S. Patent Number 5,956,135, issued to Quesnel on Sep 21, 1999, described a pipeline-inspection apparatus having a lateral-line probe inserted into a lateral line with a semi-rigid rod that was pushed incrementally with repeated gripping, advancing and releasing of the semi-rigid rod. U.S. Patent Number 4,991,006, issued to Wood on Feb. 5, 1991, described insertion of a probe camera into lateral pipelines from a main pipeline base with a protrusion from a controllable eversion hose. U.S. Patent Number 4,985,763, issued to Fraser on Jan, 15, 1991, described a water-jet nozzle for propelling inspection devices in pipelines. U.S. Patent Number 4,677,472, issued to Wood on Jun. 30, 1987, described a flexible tube advanced by pincher wheels for extending a probe laterally from a pipeline inspection base. U.S. Patent Number 4,651,558, issued to Martin *et al.* on Mar. 24, 1987, described a method and apparatus for inspecting lateral lines with an optic probe on a flexible push rod extendible from a launcher into a main pipeline with pinch rollers.

SUMMARY OF THE INVENTION

Objects of patentable novelty and utility taught by this invention are to provide a pipeline mapping system and method which:

positions a mapping probe selectively in main and lateral pipelines;

communicates mapping information intermediate the mapping probe and a mapping recorder;

removes visual obstruction from internal pipe surfaces as necessary for accurate mapping and inspection;

provides location, condition and structure mapping of the main and lateral pipelines;

provides selectively graphic and video observation and recording; and

is fast, convenient, inexpensive and accurate.

This invention accomplishes these and other objectives with a pipeline mapping system and method having a mapping probe on a probe conveyor that is positioned on a base vehicle from which the probe conveyor is extendable into a lateral pipeline selectively. The base vehicle has a vehicle motor for propulsion of the base vehicle in the main pipeline and the probe conveyor has a probe motor for propulsion of the probe conveyor in the lateral pipeline. A mapping recorder is in electronic communication with the mapping probe for recording mapping information from the mapping probe. A probe light at the probe and a vehicle light at the vehicle aid visibility of mapping information for communication by the probe.

A TV camera on the probe can be employed to convey visual observation by the probe to the mapping recorder, to a TV monitor and to a separate recorder selectively. The TV recorder can have an electronic locator for detecting a metallic mass of the mapping probe. The mapping recorder and the main vehicle can have transmitters which transmit mapping information to the TV recorder. The main vehicle can have a TV camera for communication of main-pipeline information, vehicle information and probe information to the TV monitor and to the mapping recorder selectively.

The above and other objects, features and advantages of the present invention should become even more readily apparent to those skilled in the art upon a reading of the following detailed description in conjunction with the drawings wherein there is shown and described illustrative embodiments of the invention.

BRIEF DESCRIPTION OF DRAWINGS

This invention is described by appended claims in relation to description of a preferred embodiment with reference to the following drawings which are explained briefly as follows:

FIG. 1 is a partially cutaway side view of the pipeline-mapping system; and

FIG. 2 is a partially cutaway side view of a mapping probe in a lateral pipeline.

DESCRIPTION OF PREFERRED EMBODIMENT

Listed numerically below with reference to the drawings are terms used to describe features of this invention. These terms and numbers assigned to them designate the same features throughout this description.

1. Pipeline mapping system
2. Mapping probe
3. Probe conveyor
4. Lateral pipeline
5. Base vehicle
6. Main pipeline
7. Vehicle water jet
8. Probe water jet
9. Metal locator
10. TV monitor
11. Computer
12. Ground
13. Probe emitter
14. Base emitter
15. Electronic receiver
16. Lateral-pipeline connection
17. Probe light
18. Probe TV camera
19. Vehicle light
20. Vehicle TV camera
21. Sled
22. Probe manipulator
23. Manipulation controls
24. Probe controller
25. Water conveyance
26. Jet streams

Referring to **FIGS. 1-2**, a pipeline mapping system **1** has a mapping probe **2** on a probe conveyor **3** that is extendable into a lateral pipeline **4** from a base vehicle **5** in a main pipeline **6**. The base vehicle **5** has a vehicle motor that can be a vehicle water jet **7** having jet-nozzle structure for propulsion in the main pipeline **6** selectively. The probe conveyor **3** has a probe motor that can be a probe water jet **8** having jet-nozzle structure for propulsion of the probe conveyor **3** with the mapping probe **2** thereon in the lateral pipeline **4**.

A mapping recorder, which can include a metal locator **9**, an on-site or selectively positioned TV monitor **10** and a computer **11** having graphics-producing capability for mapping positions of the mapping probe **2** on a graphic map for communication to a computer printer, which is not shown, for computer printout.

The computer **11** also can have graphics-display capability for displaying graphics produced by the computer **11**.

The mapping probe **2** can include predetermined metallic mass for location by the metal locator **9** from above ground **12** in which the mapping probe **2** is positioned. The base vehicle **5** also can have or can include predetermined metallic mass for location by the metal detector **9** from above ground **12** in which the base vehicle **5** is positioned.

The mapping probe **2** can have an electronic probe emitter **13** and the base vehicle **5** can have a base emitter **14** for electronic communication to an electronic receiver **15** for marking positions of the mapping probe **2** and of the base vehicle **5** respectively and for recording conditions and structure of the main pipeline **6**, the lateral pipeline **4** and lateral-pipeline connections **16**.

In close proximity to the probe emitter **13** on the mapping probe **2** are a probe light **17** and a probe TV camera **18** for electronic communication of conditions and structure of the main pipeline **6** when the mapping probe **2** is not in a lateral pipeline **4** and for communication of conditions and structure of the lateral pipeline **4** when the mapping probe **2** is in the lateral pipeline **4**.

A vehicle light **19** and a vehicle TV camera **20** are positioned on a portion of the base vehicle **5** that can be a sled **21** for remote viewing and controlling of a probe manipulator **22** from which the probe conveyor **3** is extendable into the lateral pipeline **4** from the base vehicle **5**. The probe manipulator **22** has electronic manipulation controls **23** that are operable remotely with a probe controller **24** for controlling activity of the mapping probe **2** selectively in relation to video display on the on-site TV monitor **10**.

A water conveyance **25** has an inlet end proximate a motor end of the base vehicle **5** for conveyance of pressured water to the vehicle water jet **7** and to the probe conveyor **3** which can include a water conveyance in fluid communication with the probe water jet **8**. Jet streams **26** are shown proximate the vehicle water jet **7** in **FIG. 1** and proximate the probe water jet **8** in **FIG. 2**. Whether or not employed as propulsion motors, the vehicle water jet **7** and the probe water jet **8** can utilize the jet streams **26** for flushing a portion of the lateral pipeline **4** and/or the main pipeline **6** for visually observing their interior conditions and structure clearly from a remote position as appropriate. Other probe motors and vehicle motors with related structure can be employed.

Using this pipeline mapping system **1** includes steps of:

placing the base vehicle **5** containing the mapping probe **2** which includes the probe TV camera **18** and the vehicle TV camera **20** with appropriate lighting from the probe light **17** and the vehicle light **19** in the main pipeline **6**;

moving and positioning the base vehicle **5** in the main pipeline **6** selectively;

visually observing interior condition and structure of the main pipeline **6** on the TV monitor **10** while map-survey probing the position and condition of the main pipeline **6** with the mapping probe **2**;

communicating position and condition of the main pipeline **6** from the mapping probe **2** to the mapping recorder which can include the metal locator **9**, the TV monitor **10** and the computer **11**;

detecting at least one lateral-pipeline connection **16** of at least one lateral pipeline **4** to the main pipeline **6**;

visually observing interior condition and structure of the lateral-pipeline connection **16** on the TV monitor **10** while map-survey probing position and condition of the lateral-pipeline connection **16** with the mapping probe **2**;

communicating position and condition of the lateral-pipeline connection **16** from the mapping probe **2** to the mapping recorder which can include the metal locator **9**, the on-site TV monitor **10** and the computer **11**;

inserting the probe conveyor **3** and the mapping probe **2** into the lateral pipeline **4** selectively;

visually observing interior condition and structure of the lateral pipeline **4** on the TV monitor **10** while probing position and interior condition of the lateral pipeline **4** with preferably the computer **11** of the mapping probe;

communicating position and condition, including any leaks or damage of the lateral pipeline **4** from the mapping probe **2** to preferably the computer **11** of the mapping recorder; and

mapping the condition, physical structure and location of the main pipeline **6** and of the lateral pipeline **4** with the mapping recorder.

A new and useful pipeline mapping system and method having been described, all such foreseeable modifications, adaptations, substitutions of equivalents, mathematical possibilities of combinations of parts, pluralities of parts, applications and forms thereof as described by the following claims and not precluded by prior art are included in this invention.